



Infrastructure ■ Engineering ■ Planning ■ Construction

1488-92
Soils / Testing

701 Xenia Avenue South
Suite 300
Minneapolis, MN 55416
Tel: 763-541-4800
Fax: 763-541-1700

Transmittal

To:	<u>Ms. Ollie Koropchak</u>	Date:	<u>November 23, 2005</u>
	<u>City of Monticello</u>	Re:	<u>Otter Creek Industrial Campus</u>
	<u>505 Walnut Street</u>		<u>City Planning No. 2004-069</u>
	<u>Suite 1</u>	Location:	<u>Monticello, MN</u>
	<u>Monticello, MN 55362</u>	Project No.:	<u>1488-92</u>

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cc: _____		By: <u>Jason Abell</u>	
_____		Tele: <u>763-287-8318</u>	



A Geotechnical Evaluation Report

Proposed Street and Utility Improvements
Otter Creek Business Campus
Monticello, Minnesota

Prepared for

WSB & Associates, Inc.

Professional Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

SE [Signature]
Steve A. Thayer, PE
Senior Engineer
License Number: 24674
March 14, 2005



Project SC-05-00534

Braun Intertec Corporation

100

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BRAUN
INTERTEC

Braun Intertec Corporation
1520 24th Avenue N
P.O. Box 189
St. Cloud, MN 56302

Phone: 320.253.9940
Fax: 320.253.3054
Web: braunintertec.com

March 14, 2005

Project SC-05-00534

Mr. Jason Abell, PE
WSB & Associates, Inc.
701 Xenia Avenue South, Suite 300
Minneapolis, MN 55416

Dear Mr. Abell:

Re: Geotechnical Evaluation
Proposed Street and Utility Improvements
Otter Creek Business Campus
Monticello, Minnesota

We have completed the geotechnical evaluation you authorized February 7, 2005. The purpose of our evaluation was to assist you in preparing plans and specifications for the installation of new utilities and construction of School Boulevard and Chelsea Road Extensions in Monticello, Minnesota.

Summary of Results

We completed fourteen borings along the proposed roadway alignments and one boring at the proposed lift station location. The borings generally encountered 1 to 2 feet of topsoil underlain by poorly graded sand. Silty sand and lean clay were encountered below the topsoil in several borings, to depths ranging from 2 to 7 feet. Groundwater was observed in the borings at depths ranging from 3 to 12 1/2 feet, corresponding to elevations ranging from 922 to 929.

Summary of Recommendations

Utilities. It is our opinion the soils encountered in the borings will support the proposed utilities. Dewatering of trenches extending below the water table will be required.

Lift Station. Based on the soils near the lift station, it appears excavation of sand, cobbles and boulders will be required to reach the invert depth of the lift station. The base slab can likely be supported on the sand and silty sand soils. The bottom of the excavation will extend 35 feet below the groundwater table. Boring ST-2 was not taken deep enough to determine the required depth(s) of the dewatering well(s). If there is a waterbearing sand or gravel stratum within 30 feet of the bottom of the excavation, the hydrostatic pressure in it should be drawn down below the bottom of the excavation prior to excavating. If it is not, upward seepage will loosen and possibly "blow the seal" on the bottom of the excavation.

Pavement. We recommend topsoil be removed from below the proposed pavement. Sand backfill and fill should then be placed and compacted to desired grades. Based on the soils observed in the borings, it appears the pavement subgrades will consist of lean clay, silty sand or poorly graded sand. These soils can have R values ranging from 8 to 70. We recommend either (1) designing the roadways for an R value of 10, or (2) providing a uniform 2-foot subcut backfilled with sand and designing the roadways for an R value of 50.

General

Please refer to the attached report for a more detailed summary of our analyses and recommendations. If we can provide additional assistance, or observation and testing services during construction, please call Steve Thayer at (320) 253-9940.

Sincerely,

BRAUN INTERTEC CORPORATION



Steve A. Thayer, PE
Senior Engineer



Bruce M. Thorson, PE
Senior Engineer

Attachments:
Geotechnical Evaluation Report

00534

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A. Introduction

A.1. Project

The City of Monticello is planning to extend Chelsea Road and School Boulevard into the proposed Otter Creek Business Campus. Construction will also include new storm sewers, sanitary sewers and water mains along the alignments. A lift station will also be constructed on the west side of Chelsea Road, south of its intersection with County State Aid Highway 39.

A.2. Purpose of This Evaluation

The purpose of this geotechnical evaluation was to assist WSB & Associates, Inc. (WSB), civil engineers for the City of Monticello, in designing the proposed utilities, lift station and pavements, and in preparing plans and specifications for their construction.

A.3. Scope

Mr. Jason Abell, with WSB, requested a proposal for soil borings and a geotechnical evaluation report on January 31, 2005. We submitted a proposal to Mr. Abell on February 7, which he signed and returned as authorization to proceed on the same day.

Our scope of services was limited to:

- coordinating the locating of any underground utilities near the boring locations,
- conducting 14 penetration test borings to a depth of 15 feet and one to a depth of 50 feet,
- classifying the samples and preparing boring logs,
- analyzing the results of the field and laboratory tests,
- formulating preliminary recommendations for the utility installations and pavement construction,
- discussing the results and preliminary recommendations with Mr. Abell, and
- submitting a geotechnical evaluation report containing logs of the borings, analysis of the field tests, and recommendations for the utility installations and pavement construction.

A.4. Documents Provided

Mr. Abell provided us with copies of the Proposed Boring Locations plan and Typical Section prepared by WSB and dated January 2005.

A.5. Locations and Elevations

We performed the borings adjacent the locations staked by WSB. The staked locations of Borings ST-1 and ST-11 were not accessible to our truck-mounted rig because of trees. We offset these locations. The locations we drilled are designated with the suffix "A". The offsets are shown on the Log of Boring sheet in the "Location" box.

Ground surface elevations at the borings were provided by WSB.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances and groundwater observations are included in the Appendix. Fence diagrams summarizing the borings follow this page. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. It should be noted that the depths shown as changes between the strata are only approximate. The changes are likely transitions, and the depths of the changes vary between the borings.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional histories of the alignments. Because of the complex glacial and post-glacial depositional environments, geologic origins are frequently difficult to ascertain. A detailed investigation of the geologic histories of the alignments was not performed.

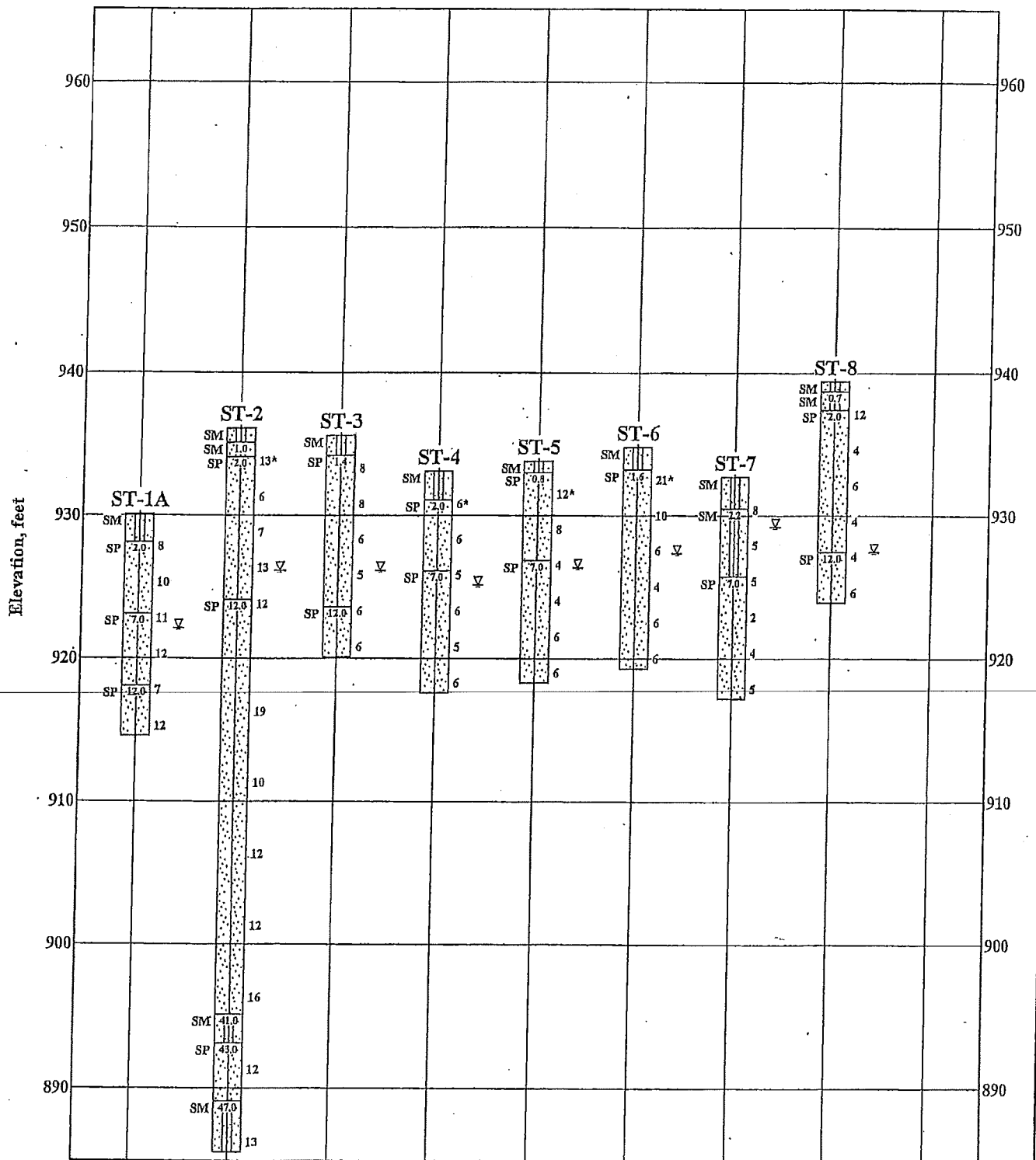
B.2. Site Conditions

The proposed site is a grass-covered field with a few trees. There is also a low area near the middle of the site. The site is rolling, with elevations at our borings ranging from 930.1 to 962.7.

B.3. Soils

We completed 14 borings along the proposed utility and roadway alignments. The borings generally encountered 1 to 2 feet of topsoil underlain by poorly graded sand. Borings ST-7, ST-8, ST-11A and ST-14, however, encountered silty sand below the topsoil to depths ranging from 2 to 7 feet. Boring ST-9 encountered lean clay below the topsoil to a depth of 4 feet. Poorly graded sand was encountered below the silty sand and lean clay.

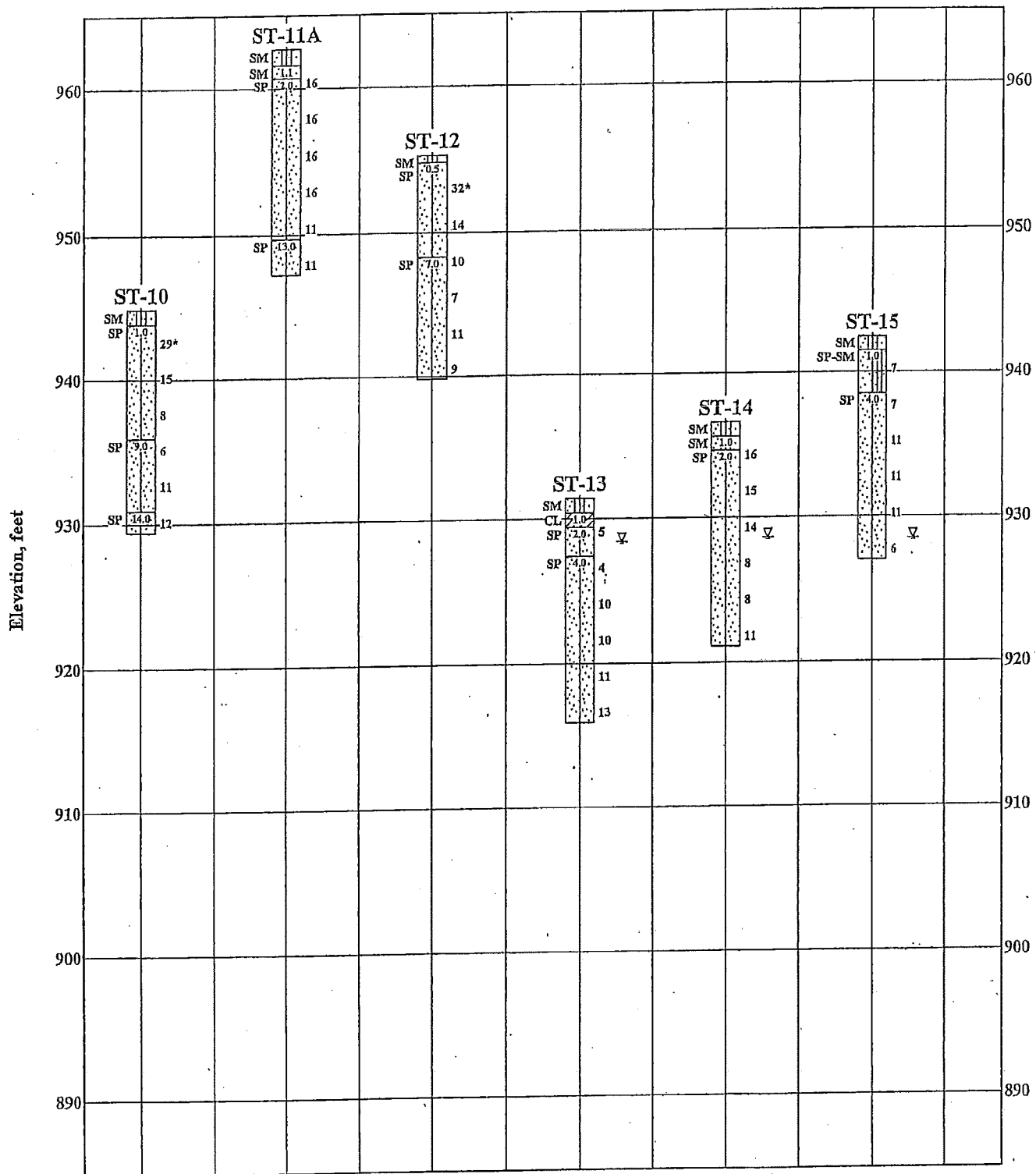
Boring ST-2 was completed at the location of the proposed lift station. It encountered about a foot of topsoil over a foot of silty sand over poorly graded sand. Silty sand was encountered below the poorly graded sand from 41 to 43 feet and below 47 feet.



Fence Diagram: Point to Point
(Horizontal distance not to scale)

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Fence Diagram: Point to Point
(Horizontal distance not to scale)

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Otter Creek Business Campus
Monticello, Minnesota

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Penetration resistances in the poorly graded sands ranged from 2 to 19 blows per foot (BPF), indicating they ranged from very loose to medium dense. The penetration resistances in the shallow silty sands were 5 and 8 BPF, indicating they were loose. The penetration resistance in the silty sand at depth in Boring ST-2 was 13 BPF, indicating it was medium dense.

B.4. Groundwater

Groundwater was generally observed in the borings at depths ranging from 3 to 12 1/2 feet while drilling. After the hollow-stem auger had reached the bottoms of the holes, groundwater was observed at depths ranging from 4 to 12 feet. After the auger had been withdrawn from the holes, groundwater was not observed to cave-in depths ranging from 3 to 10 feet.

Based on these observations and the moisture contents of the penetration test samples, it appears the groundwater surface ranges from elevation 922 to 929, and that it tends to slope downwards to the north.

Seasonal and annual fluctuations of the groundwater levels should be anticipated. Elevated levels should be anticipated following spring thaw and wet weather.

C. Analyses and Recommendations

C.1. Proposed Construction

Mr. Abell indicated construction will consist of installing water mains, sanitary sewers and storm sewers. The utility invert depths will range from 5 to 10 feet, except at the connection with the lift station, where the sewer will be deeper. The lift station will have a base slab depth of about 45 feet.

An urban road section roadway with curb and gutter will then be constructed. The finished grades will generally be near existing grades. We have assumed the roadway and its subgrades will be designed and constructed in general accordance with current Minnesota Department of Transportation (Mn/DOT) standards and specifications.

If our understanding of the proposed project is not correct, or if the proposed grades differ from the assumed grades, we should be informed. Additional analyses and revised recommendations may be necessary.

C.2. Discussion

C.2.a. Utilites. It is our opinion the soils encountered in the borings will support the proposed utilities. Most of the trench sidewalls will be Type C soils. Dewatering will be required in trenches extending below the groundwater table.

C.2.b. Lift Station. We anticipate the lift station will be supported on naturally deposited sand. The bottom of the excavation will extend 35 feet below the groundwater table. Boring ST-2 was not taken deep enough to determine the required depth(s) of the dewatering well(s). If there is a waterbearing sand or gravel stratum within 30 feet of the bottom of the excavation, the hydrostatic pressure in it should be drawn down below the bottom of the excavation prior to excavating. If it is not, upward seepage will loosen and possibly "blow the seal" on the bottom of the excavation.

C.2.c. Pavement. We anticipate the pavement subgrade soils will generally be poorly graded sand. Poorly graded sand is an excellent subgrade material. A foot of silty sand was encountered under the topsoil in three of the fourteen roadway borings. Two feet of lean clay was encountered under the topsoil in a fourth boring, and five feet of silty sand was encountered under the topsoil in a fifth boring. The R value of the pavement subgrade can be increased by replacing these soils in the upper two feet of the subgrade with poorly graded sands from elsewhere along the alignments.

C.3. Utilities

C.3.a. Utility Trench Subgrades. The borings indicate poorly graded sand will be encountered at the anticipated invert depths. The sands appear suitable for support of the proposed utilities.

C.3.b. Corrosion Protection. Sands are generally noncorrosive with regard to concrete, metal and thermoplastic pipes.

C.3.c. Bedding Material. We recommend using excavated or imported poorly graded sand or poorly graded sand with silt (ASTM symbol "SP" or "SP-SM") or imported gravel as bedding material for the pipes.

C.3.d. Backfill. The excavated materials, except for the topsoils, may be reused as backfill above the bedding. Silty sand is often a frost-susceptible soil; we recommend it be buried at least 2 feet below the pavement subgrade level.

C.3.e. Compaction. In proposed green areas, we recommend the backfill be compacted to a minimum of 90 percent of its maximum dry density determined in accordance with American Society for Testing and Materials (ASTM) Method of Test D 698 (standard Proctor). Below proposed and future pavements, the backfill should be compacted to a minimum of 95 percent. The upper 3 feet should be compacted to a minimum of 100 percent.

C.4. Lift Station

C.4.a. Excavation. Excavation and dewatering are discussed in Sections D.1 and D.2 below. As indicated in the discussion above, Boring ST-2 should be extended to a depth of 80 feet to help dewatering contractors determine the required depth(s) of dewatering well(s).

C.4.b. Foundation Subgrade Preparation. We anticipate the subgrade will consist of medium dense poorly graded sand.

C.4.c. Bearing Capacity. The penetration resistances indicate undisturbed natural sand in the excavation bottom have a net allowable bearing pressure up to 2,500 pounds per square foot (psf). This net allowable bearing pressure includes a factor of safety of at least three with regard to punching failure.

C.4.d. Hydrostatic Uplift. Resistance to uplift is provided by the weight of the lift station, soil backfill over any projection of the base slab, and backfill within the frustrum of an inverted cone extending upward and outward from the top edge of the base slab at an angle of 20 degrees.

We recommend assuming a design groundwater level approximately 5 feet below the ground surface. We recommend assuming the total (moist) and effective (submerged) unit weights of the sand backfill will be 115 and 60 pcf, respectively. The effective unit weights should be used below the assumed design groundwater depth.

C.4.e. Backfill. We recommend the backfill surrounding the lift station should be compacted to a minimum of 90 percent of its maximum dry density. If the backfill will be supporting a pavement, we recommend compacting it to a minimum of 95 percent, and 100 percent in the upper three feet beneath the pavement.

C.5. Pavement

C.5.a. Subgrade Preparation. We recommend that topsoils be completely removed from below the proposed pavements and to 1 foot behind the curbs and gutters. After the topsoil has been stripped, sand will be exposed at nine of the fourteen boring locations. Sand is an excellent pavement subgrade

material. By removing 1 foot of additional material at the five remaining boring locations (ST-7, ST-8, ST-9, ST-11A and ST-14) and replacing it with sand from elsewhere on the alignment, sand will become the only subgrade material at 12 of the 14 boring locations. By removing an additional foot of material at the locations of Borings ST-7 and ST-9 and replacing it with sand from elsewhere on the alignment, sand will become the only subgrade material at 13 of the 14 boring locations. This will permit the pavement to be designed with an R value of 50. If an R value of 70 is desired, 2 additional feet of silty sand should be removed at the location of Boring ST-7.

We recommend the stripped surface be scarified and mixed to a depth of at least 6 inches, moisture-conditioned, and surface compacted to a minimum of 95 percent. If there are areas which become unstable, we recommend the unstable materials be subexcavated to a depth of about 2 to 3 feet and be replaced by materials that can be compacted.

Where backfill and fill are required, we recommend that sand (Select Granular Borrow) with less than 12 percent silt and clay be used. We recommend the sand be compacted to a minimum of 95 percent of its standard Proctor maximum dry density. In the upper 3 feet of the subgrade, we recommend compaction to 100 percent of its maximum dry density.

As a final check prior to placement of the aggregate base, we recommend that all pavement subgrades be proofrolled. This precautionary measure will assist in detecting localized soft spots. Any soft spots noted during the proofrolling process may require additional subcuts.

C.5.b. Anticipated Subgrade. After preparation, we anticipate the subgrade will generally consist of compacted poorly graded sand (Select Granular Borrow). Silty sand or lean clay could be present along some of the alignments, however. Laboratory tests to determine the resistance (R) values of potential subgrade materials were not included in our scope of services. The Minnesota Department of Transportation (Mn/DOT) *Geotechnical and Pavement Manual* indicates R values of these soils range from 80 to 8. If the silty and clayey soils are present in the upper 2 feet of the pavement subgrade, we recommend the proposed pavement be designed with an R value of 10.

If silty and clayey soils are removed and not used for backfill in the upper 2 feet of the pavement subgrade, and only poorly graded sand soils or imported select granular borrow are allowed in the upper 2 feet, an R value of 50 may be used to design the pavement. If only poorly graded sand soils or imported select granular borrow are allowed in the upper 4 feet, an R value of 70 may be used to design the pavement.

C.5.c. Materials and Compaction. We recommend specifying Select Granular Borrow meeting the requirements of Mn/DOT Specification 3149.2B2. On-site sands with ASTM "SP" and "SP-SM" classifications will likely meet Select Granular Borrow Specifications. We recommend specifying crushed gravel base meeting the requirements of Mn/DOT Specification 3138 for Class 5 or Class 6. We recommend the bituminous meet the requirements of Specification 2360.

We recommend the crushed gravel base be compacted to a minimum of 100 percent of its standard Proctor maximum dry density. We recommend the asphaltic concrete surface be compacted to a minimum of 92 percent of its theoretical maximum density. We recommend Portland cement concrete meet the requirements of Specification 2301.

D. Construction

D.1. Excavation

It is our opinion most of the soils encountered by the borings can be generally be excavated with a backhoe, front-end loader, motor grader or scraper.

The borings indicate the sand and silty sand soils will likely be Type C soils under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. Excavations deeper than 20 feet need to be designed by a licensed engineer.

Slow upward seepage will likely be occurring in the bottom of the lift station excavation. Consideration should be given to subexcavating several inches and placing a working mat of lean concrete or crushed gravel.

D.2. Dewatering

Where the trench bottoms extend only 1 to 2 feet below the groundwater level, we anticipate dewatering can be accomplished by pumping water from sumps placed in the low points of the trenches. Where the trenches or excavations extend more than 2 feet into waterbearing sands, well points or deep wells will likely be necessary. Where the trenches or excavations extend more than 20 feet below the surface, staged well points or deep wells will likely be necessary.

The required depth(s) of the dewatering wells for the lift station cannot be determined from Boring ST-2. If there is a waterbearing sand stratum within 30 feet of the bottom of the excavation, the dewatering well(s) must penetrate into it and pull the hydrostatic pressure in it down to a level below the bottom of the excavation prior to excavating.

D.3. Observations

We recommend all excavation and pavement subgrades be observed by a geotechnical engineer to evaluate if the subgrade soils are similar to those encountered by the borings and adequate to support the proposed construction. Removal of topsoils should be verified. Removal of silty sands and lean clays should be observed if the pavement is designed for a subgrade with an R value higher than 10. Proofrolling of the pavement subgrade and gravel base should be observed. These observations should be conducted prior to placing backfill or fill.

D.4. Testing

Samples of proposed backfill and fill materials should be submitted to a testing laboratory at least three days prior to placement for evaluation of their suitability and determination of their optimum moisture contents and maximum dry densities. Sieve analysis tests should be conducted on proposed Select Granular Borrow.

We recommend density testing be performed in all backfill and fill placed beneath pavements. Utility trench backfill should be tested every 500 feet at vertical intervals not exceeding 2 feet. We also recommend density testing of the compacted pavement subgrade and gravel base course.

D.5. Cold Weather

If site grading is anticipated during cold weather, we recommend good winter construction practices be observed. All snow and ice should be removed from cut and fill areas prior to grading.

Pavement subgrades should not be constructed during periods when the subgrade material freezes while being placed and compacted, nor should any subgrade material be placed on soil that is frozen to a depth greater than 4 inches. When the foundation soils are frozen to a depth exceeding 4 inches, at a time when weather conditions are such that subgrade construction could be continued without the material freezing as it is being placed and compacted, the contractor may be permitted to excavate the frozen foundation soil and proceed with the subgrade construction for so long as the weather will permit with the understanding that Yielding areas should be corrected. the additional costs involved shall be borne by the contractor. The frozen soil should be pulverized or wasted and replaced with other suitable soil, as may be necessary to construct the subgrades as specified.

E. Procedures

E.1. Drilling and Sampling

We performed the penetration test borings on February 16 and 17, 2005, with a truck-mounted core and auger drill equipped with 3 1/4-inch inside diameter hollow-stem auger. Sampling for the penetration

test borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." We advanced the boreholes with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 1 1/2 feet below the tip of the hollow-stem auger. The blows for the last foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 1/2-foot vertical intervals to a depth of 15 feet and then at 5-foot intervals. A portion of each sample was sealed in a glass jar.

E.2. Soil Classifications

The drill crew chief visually and manually classified the soils encountered in the borings in accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedures)." A summary of the ASTM classification system is included in the Appendix. The penetration test samples were then returned to our laboratory for review of the field classifications by a geotechnical engineer. Samples will remain in our St. Cloud office for a period of 60 days to be available for your examination. These samples will then be discarded unless we are notified in writing to retain them longer.

E.3. Groundwater Observations

The depths at which groundwater was first observed while advancing the borings was recorded. Immediately after taking the final samples in the bottoms of the borings, the crew probed the holes through the hollow-stem auger to check for the presence of groundwater. Immediately after withdrawal of the auger, the holes were again probed and the depths to cave-ins were noted. The borings were then immediately backfilled.

F. General Recommendations

F.1. Basis of Recommendations

The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the sketch in the Appendix. Often, variations occur between these borings, the nature and extent of which do not become evident until additional exploration or construction is conducted. Variations should be expected due to the large spacing of the borings. A re-evaluation of the recommendations in this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional costs, and it is suggested that a contingency be provided for this purpose.

We recommend that we be retained to perform the observation and testing program for the utility installation and roadway grading phases of this project. This will allow correlation of the soil conditions encountered during construction to the soil borings, and will provide continuity of professional responsibility.

F.2. Review of Design

This report is based on the design of the proposed utilities and roadways as related to us for preparation of this report. We recommend that we be retained to review the geotechnical aspects of the designs and specifications. With the review, we will evaluate whether any changes in design have affected the validity of the recommendations, and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

F.3. Groundwater Fluctuations

We made water level observations in the borings at the times and under the conditions stated on the boring logs. These data were interpreted in the text of this report. The periods of observation were relatively short, and fluctuations in groundwater levels may occur due to rainfall, flooding, irrigation, spring thaw, drainage, and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

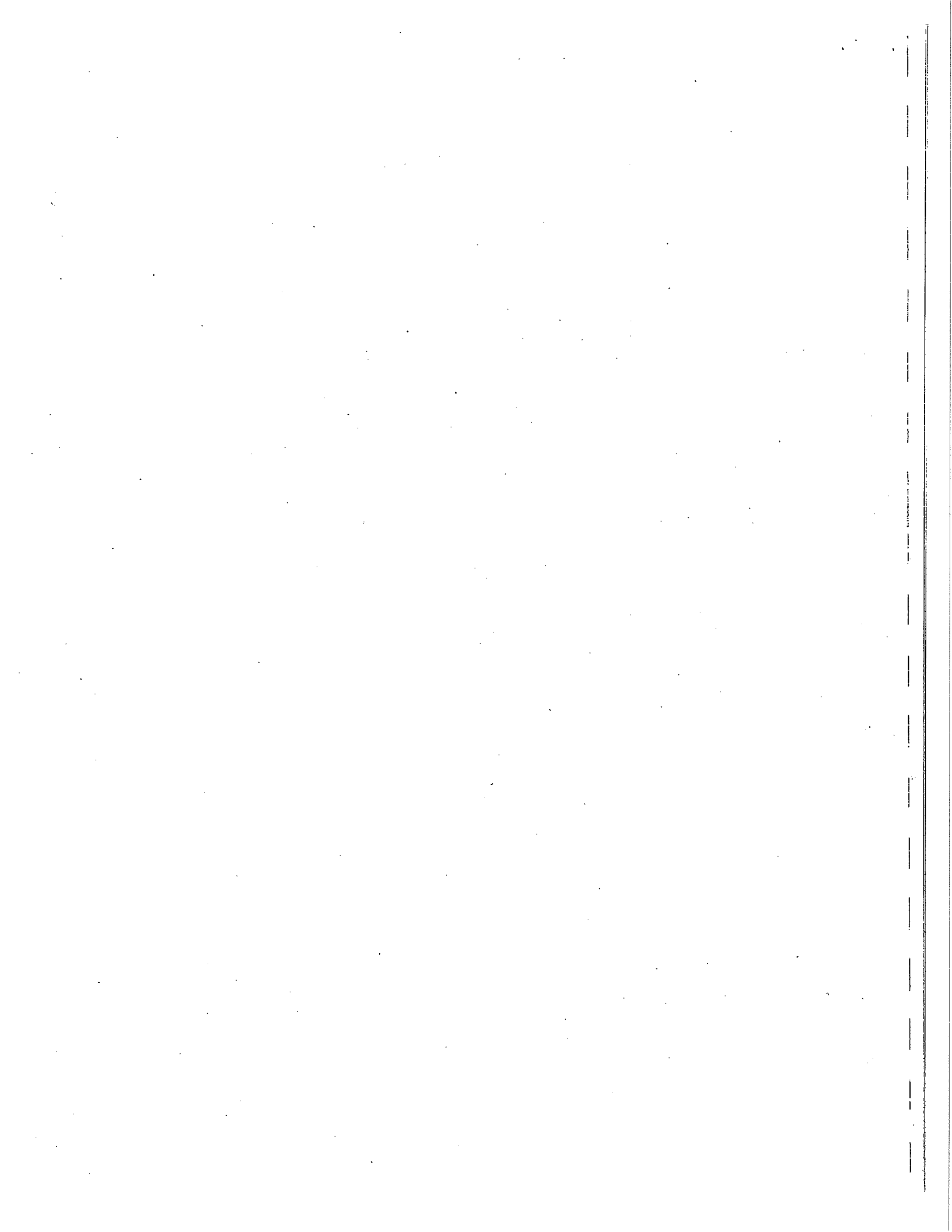
F.4. Use of Report

This report is for the exclusive use of the City of Monticello and their civil engineer, WSB, to use to design the proposed utilities and pavement, and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analyses and recommendations may not be appropriate for other purposes. We recommend that parties contemplating other purposes contact us.

F.5. Level of Care

Services performed by Braun Intertec Corporation personnel for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

Appendix



Descriptive Terminology

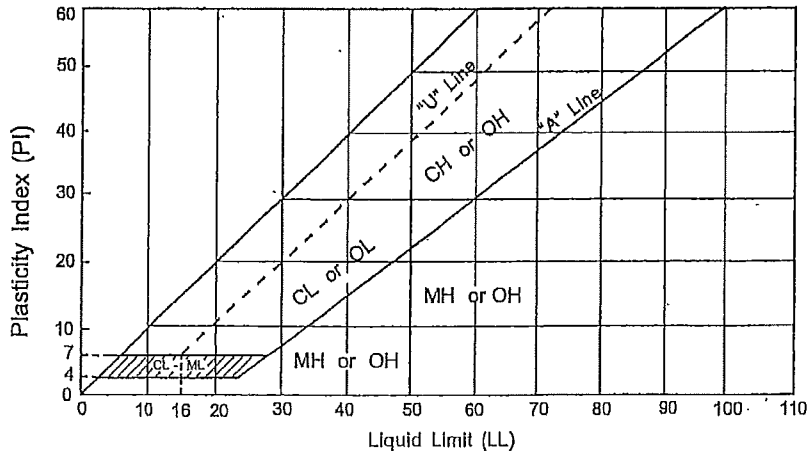
Rev. 10/04



Standard D 2487 - 00 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^a					Soils Classification	
					Group Symbol	Group Name ^b
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^a	$C_u \geq 4$ and $1 \leq C_c \leq 3$ ^c	GW	Well-graded gravel ^d	
			$C_u < 4$ and/or $1 > C_c > 3$ ^c	GP	Poorly graded gravel ^d	
		Gravels with Fines More than 12% fines ^a	Fines classify as ML or MH	GM	Silty gravel ^{d f g}	
			Fines classify as CL or CH	GC	Clayey gravel ^{d f g}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ⁱ	$C_u \geq 6$ and $1 \leq C_c \leq 3$ ^c	SW	Well-graded sand ^h	
			$C_u < 6$ and/or $1 > C_c > 3$ ^c	SP	Poorly graded sand ^h	
		Sands with Fines More than 12% ⁱ	Fines classify as ML or MH	SM	Silty sand ^{f g h}	
			Fines classify as CL or CH	SC	Clayey sand ^{f g h}	
Fine-grained Soils 50% or more passed the No. 200 sieve	Silt and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line ⁱ	CL	Lean clay ^{k l m}	
			PI < 4 or plots below "A" line ⁱ	ML	Silt ^{k l m}	
		Organic	Liquid limit - oven dried	OL	Organic clay ^{k l m n}	
			Liquid limit - not dried < 0.75	OL	Organic silt ^{k l m o}	
	Silt and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{k l m}	
			PI plots below "A" line	MH	Elastic silt ^{k l m}	
		Organic	Liquid limit - oven dried	OH	Organic clay ^{k l m p}	
			Liquid limit - not dried < 0.75	OH	Organic silt ^{k l m q}	
Highly Organic Soils		Primarily organic matter, dark in color and organic odor			PT	Peat

- a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	ϕ	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P2000	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 30" or 60" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1" or 30" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

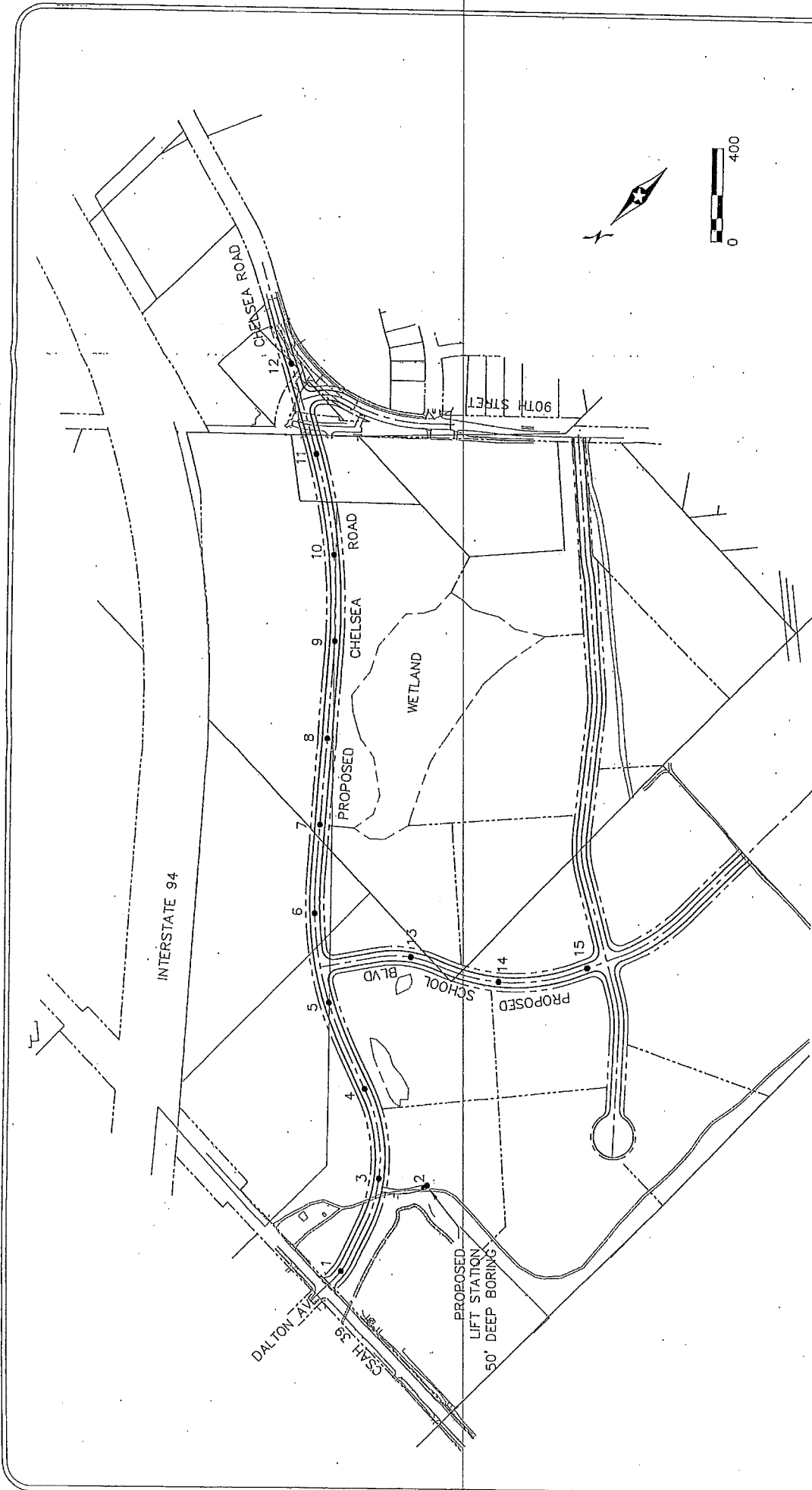
BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.



WSB Project No. January, 2005

OTTER CREEK BUSINESS CAMPUS
PROPOSED BORING LOCATIONS

Figure Number
1

Monticello, Minnesota

701 Xerxes Avenue South, Suite 300
Minneapolis, MN 55418
www.wsb.org



TELEPHONE: 612.344.0000
FACSIMILE: 612.344.0000
E-MAIL: wsb@wsb.org

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota						BORING: ST-1A LOCATION: 9'N to avoid trees. See sketch.	
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet 930.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
		SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			Ground surface elevations of the borings were provided by WSB & Associates. The triangle in the WL column indicates the highest level at which groundwater was observed while drilling. Groundwater levels fluctuate. Please refer to the discussions in Sections B.4. and F.3. of our report.	
928.1	2.0	SP	POORLY GRADED SAND, fine-grained, brown, moist, loose. (Glacial Outwash)	8			
				10			
923.1	7.0	SP	POORLY GRADED SAND, fine- to medium- to coarse-grained, with GRAVEL, gray, waterbearing, medium dense. (Glacial Outwash)	11	▽		
				12			
918.1	12.0	SP	POORLY GRADED SAND, fine- to medium-grained, gray, waterbearing, loose to medium dense. (Glacial Outwash)	7			
914.6	15.5		END OF BORING	12			
			Water observed at 8 feet while drilling. Water down 8 feet with 14 feet of hollow-stem auger in the hole. Water not observed to cave-in depth of 5 1/2 feet immediately after withdrawal of auger. Boring then backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534
 Geotechnical Evaluation
 Utility and Road Construction
 Otter Creek Business Campus
 Monticello, Minnesota

BORING: ST-2

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/16/05

SCALE: 1" = 4'

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
936.1	0.0					
935.1	1.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
934.1	2.0	SM	SILTY SAND, fine-grained, brown, frozen. (Alluvium)			
		SP	POORLY GRADED SAND, fine- to medium-grained, brown, frozen to moist, loose. (Glacial Outwash)	13*		*frozen
				6		
				7		
				13	▽	
924.1	12.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with GRAVEL, brown, wet to waterbearing, medium dense. (Glacial Outwash)	12		
				19		
				10		
				12		

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUNGDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota						BORING: ST-2 (cont.) LOCATION: See sketch.		
DRILLER: D. Ruchti			METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes		
			POORLY GRADED SAND, fine- to coarse-grained, with GRAVEL, brown, wet to waterbearing, medium dense. (Glacial Outwash) <i>(continued)</i>					
				12				
				16				
895.1	41.0	SM	SILTY SAND, fine- to medium-grained, reddish brown, wet, medium dense.					
893.1	43.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with GRAVEL, brown, wet to waterbearing, medium dense.					
889.1	47.0	SM	SILTY SAND, fine- to medium-grained, reddish brown, wet, medium dense. (Glacial Till)					
885.6	50.5			13				
			END OF BORING					
			Water observed at 10 feet while drilling.					
			Water down 12 feet with 49 feet of hollow-stem auger in the hole.					
			Water not observed to cave-in depth of 9 feet immediately after withdrawal of auger.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-3 LOCATION: See sketch.	
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05	SCALE: 1" = 4'	

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
935.6	0.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
934.2	1.4	SP	POORLY GRADED SAND, fine-grained; brown to dark brown, moist, loose. (Glacial Outwash)	8		
				8		
				6		
				5	▽	
923.6	12.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, waterbearing, loose. (Glacial Outwash)	6		
				6		
920.1	15.5		END OF BORING			
			Water observed at 9 1/2 feet while drilling.			
			Water down 10 feet with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-4 LOCATION: See sketch.		
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
933.1	0.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)				
931.1	2.0	SP	POORLY GRADED SAND, fine-grained, brown, frozen to moist, loose. (Glacial Outwash)	6*		*frozen	
926.1	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, gray, wet to waterbearing, loose. (Glacial Outwash)	5	▽		
917.6	15.5		END OF BORING	6			
			Water observed at 8 feet while drilling. Water down 8 1/2 feet with 14 feet of hollow-stem auger in the hole. Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger. Boring then backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-5 LOCATION: See sketch.	
DRILLER: D. Ruchti			METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05	SCALE: 1" = 4'
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
933.8	0.0					
933.0	0.8	SM	SILTY SAND, fine-grained, dark brown, frozen. (Topsoil)			
		SP	POORLY GRADED SAND, fine-grained, brown, frozen to moist, loose. (Glacial Outwash)	12*		*frozen
				8		
926.8	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, gray, wet to waterbearing, very loose. (Glacial Outwash)	4	▽	
				4		
				6		
				6		
918.3	15.5		END OF BORING			
			Water observed at 7 1/2 feet while drilling.			
			Water down 8 feet with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-6 LOCATION: See sketch.		
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
934.8	0.0						
933.2	1.6	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)				
		SP	POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, brown, frozen to moist to wet to waterbearing, loose to very loose. (Glacial Outwash)	21*		*frozen	
				10			
				6	▽		
				4			
				6			
919.3	15.5		END OF BORING	6			
			Water observed at 7 1/2 feet while drilling.				
			Water down 8 feet with 14 feet of hollow-stem auger in the hole.				
			Water not observed to cave-in depth of 4 1/2 feet immediately after withdrawal of auger.				
			Boring then backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUNGDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-7 LOCATION: See sketch.	
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05	SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
932.7	0.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
930.5	2.2	SM	SILTY SAND, fine- to medium-grained, with layers of Sand, gray, wet to waterbearing, loose. (Glacial Outwash)	8	▽	
925.7	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, gray, waterbearing, very loose to loose. (Glacial Outwash)	5		
917.2	15.5		END OF BORING Water observed at 3 1/2 feet while drilling. Water down 4 feet with 14 feet of hollow-stem auger in the hole. Water observed at cave-in depth of 3 1/2 feet immediately after withdrawal of auger. Boring then backfilled.	5		

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota						BORING: ST-8 LOCATION: See sketch.		
DRILLER: D. Ruchti			METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes		
939.4	0.0							
938.7	0.7	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)					
937.4	2.0	SM	SILTY SAND, fine- to medium-grained, brown, frozen. (Alluvium)					
		SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist, medium dense to very loose. (Glacial Outwash)	12				
				4				
			-dark brown layer at 7 feet.	6				
				4				
927.4	12.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, gray, waterbearing, very loose to loose. (Glacial Outwash)	4	▽			
923.9	15.5			6				
			END OF BORING					
			Water observed at 12 1/2 feet while drilling.					
			Water down 12 feet with 14 feet of hollow-stem auger in the hole.					
			Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534

Geotechnical Evaluation
Utility and Road Construction
Otter Creek Business Campus
Monticello, Minnesota

BORING: ST-9

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/16/05

SCALE: 1" = 4'

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
936.4	0.0	CL	LEAN CLAY, black, frozen. (Topsoil)			
934.5	1.9	CL	LEAN CLAY, brown, moist, medium. (Alluvium)	8		
932.4	4.0	SP	POORLY GRADED SAND, fine- to medium- to coarse-grained, with GRAVEL, brown, moist to wet to waterbearing, loose to very loose. (Glacial Outwash)	8		
				8	▽	
				4		
925.4	11.0	SP	POORLY GRADED SAND, fine- to medium-grained, gray, waterbearing, loose. (Glacial Outwash)	7		
				10		
920.9	15.5		END OF BORING Water observed at 8 feet while drilling. Water down 10 1/2 feet with 14 feet of hollow-stem auger in the hole. Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger. Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota						BORING: ST-10 LOCATION: See sketch.		
DRILLER: D. Ruchti			METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes		
944.9	0.0							
943.9	1.0	SM	SILTY SAND, fine-grained, dark brown, frozen. (Topsoil)					
		SP	POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, brown, frozen to moist, medium dense to loose. (Glacial Outwash)	29*		*frozen		
				15				
				8				
935.9	9.0							
		SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist, loose. (Glacial Outwash)	6				
				11				
930.9	14.0							
		SP	POORLY GRADED SAND, fine- to medium- to coarse-grained, with GRAVEL, brown, moist, medium dense. (Glacial Outwash)	12				
929.4	15.5							
			END OF BORING					
			Water not observed while drilling.					
			Water not observed with 14 feet of hollow-stem auger in the hole.					
			Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger.					
			Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUNGDT 3/4/05 13:43

Braun Project SC-05-00534 Geotechnical Evaluation Utility and Road Construction Otter Creek Business Campus Monticello, Minnesota					BORING: ST-11A LOCATION: 9'E to avoid trees. See sketch.	
DRILLER: D. Ruchti		METHOD: 3 1/4" HSA, Autohmr.		DATE: 2/16/05	SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
962.7	0.0					
961.6	1.1	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
960.7	2.0	SM	SILTY SAND, fine- to medium-grained, brown, frozen. (Alluvium)			
		SP	POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, brown, frozen to moist, medium dense. (Glacial Outwash)	16		
				16		
				16		
				16		
949.7	13.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	11		
947.2	15.5		END OF BORING	11		
			Water not observed while drilling.			
			Water not observed with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

INTERTEC

Braun Project SC-05-00534

Geotechnical Evaluation

Utility and Road Construction

Otter Creek Business Campus

Monticello, Minnesota

BORING: **ST-12**

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/16/05

SCALE: 1" = 4'

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
955.3	0.0					
954.8	0.5	SM SP	SILTY SAND, fine-grained, dark brown, frozen. (Topsoil)			
			POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, Cobbles, brown, frozen to moist, medium dense to loose. (Glacial Outwash)	32*		*frozen
				14		
948.3	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist, loose to medium dense. (Glacial Outwash)	10		
				7		
				11		
939.8	15.5		END OF BORING	9		
			Water not observed while drilling.			
			Water not observed with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 6 1/2 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

INTERTEC

Braun Project SC-05-00534

Geotechnical Evaluation
Utility and Road Construction
Otter Creek Business Campus
Monticello, Minnesota

BORING: **ST-13**

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/17/05

SCALE: 1" = 4'

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN GDT 3/14/05 13:43

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
931.4	0.0					
930.4	1.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
929.4	2.0	CL	LEAN CLAY, black, frozen. (Topsoil)			
		SP	POORLY GRADED SAND, fine- to medium-grained, brown, frozen, loose. (Glacial Outwash)	5	▽	
927.4	4.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with GRAVEL, brown, waterbearing, very loose to loose. (Glacial Outwash)	4		
				10		
				10		
				11		
				13		
915.9	15.5		END OF BORING			
			Water observed at 3 feet while drilling.			
			Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

INTERTEC

Braun Project SC-05-00534

Geotechnical Evaluation
Utility and Road Construction
Otter Creek Business Campus
Monticello, Minnesota

BORING: ST-14

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/17/05

SCALE: 1" = 4'

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
936.6	0.0					
935.6	1.0	SM	SILTY SAND, fine-grained, dark brown, frozen. (Topsoil)			
934.6	2.0	SM	SILTY SAND, fine-grained, brown, frozen. (Alluvium)			
		SP	POORLY GRADED SAND, fine- to coarse-grained, trace Gravel, brown, frozen to moist to wet to waterbearing. (Glacial Outwash)	16		
				15		
				14	▽	
				8		
				8		
				11		
921.1	15.5		END OF BORING			
			Water observed at 8 feet while drilling.			
			Water down 9 feet with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.			
			Boring then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

INTERTEC

Braun Project SC-05-00534

Geotechnical Evaluation
Utility and Road Construction
Otter Creek Business Campus
Monticello, Minnesota

BORING: **ST-15**

LOCATION: See sketch.

DRILLER: D. Ruchti

METHOD: 3 1/4" HSA, Autohmr.

DATE: 2/17/05

SCALE: 1" = 4'

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00534.GPJ BRAUN.GDT 3/14/05 13:43

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
942.5	0.0					
941.5	1.0	SM	SILTY SAND, fine-grained, black, frozen. (Topsoil)			
		SP- SM	POORLY GRADED SAND, fine- to medium-grained, with SILT, trace Gravel, brown, frozen to moist, loose. (Glacial Outwash)	7		
938.5	4.0					
		SP	POORLY GRADED SAND, fine- to medium-grained, with GRAVEL, brown, moist to wet to waterbearing, loose to medium dense to very loose. (Glacial Outwash)	7		
				11		
				11		
				11		
				11		
					▽	
				6		
927.0	15.5					
			END OF BORING			
			Water not observed while drilling.			
			Water down 14 feet with 14 feet of hollow-stem auger in the hole.			
			Water not observed to cave-in depth of 9 feet immediately after withdrawal of auger.			
			Boring then backfilled.			